MICROTHERM
Heat Stress WBGT
And WinHSM
Application Software
User Manual

HB3279-04

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WARNINGS !

Any attempt to charge non-rechargeable cells is hazardous and can result in damage.

This instrument incorporates an internal fast-charger circuit suitable for recharging NiMH cells. The charger is enabled/disabled via a switch in the battery compartment. (See Figure 9 in Section 2.1.1.)

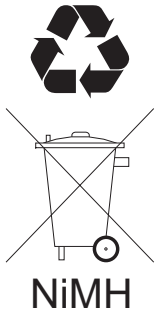
This instrument is delivered with re-chargeable nickel-cadmium cells and with the CHARGER circuit ENABLED.

DISABLE the charger circuit before fitting and using non-rechargeable cells.

DISPOSAL OF NiMH BATTERIES

Rechargeable batteries contain NiMH and must be disposed of in a safe manner. In some countries, this may involve specialist licensed waste disposal companies.

Used batteries MUST NEVER be disposed of by placing in a fire or incinerator, nor must they be punctured, crushed or otherwise mutilated or opened up in anyway.



MICROTHERM instruments contain no user serviceable components. If an electrical fault is suspected the instrument must be returned to Casella CEL Ltd for repair.

The instrument and sensors contain delicate components. They should not be dropped or subjected to mechanical shock. Failure to comply will render the warranty invalid.

GETTING STARTED

It is suggested that you prepare and operate your Microtherm following the sequence of sections in the Operations Chapter:

Preparation,

Measurement,

Logging.

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1. DESCRIPTION OF THE MICROTHERM

1.1 Background

A person's thermal comfort is mainly related to the thermal balance of their body as a whole. This balance is influenced by their physical activity and clothing, as well as the environmental parameters of, air temperature, mean radiant temperature, air velocity and air humidity.

Problems of heat stress are common in workplaces such as foundries, steel mills, brick glass and ceramic factories, power generation plants, coke ovens, laundries, modern glass buildings with inadequate air conditioning, mines and many other types of outdoor work in hot climates.

Whenever heat stress is imposed on the human body, there is a resulting strain which may result in physiological reactions such as sweat production, increased heart rate and higher core temperature. The greater the heat stress, the greater heat strain and under certain conditions, the latter may attain such magnitude as to cause damage to health.

Several indices have been designed to integrate the environmental factors contributing to heat stress and one such index is the Wet Bulb Globe Temperature Index. The WBGT index was initially developed to provide a simple method for assessment of heat stress among military personnel. The Microtherm Heat Stress WBGT determines two WBGT values.

For inside applications and outside measurements with no solar load, the WBGT inside value is used.

$$WBGTin = 0.7tnw + 0.3ta$$

For outside measurements with solar load, the WBGT outside value is used.

$$WBGTout = 0.7tnw + 0.2tg + 0.1ta$$

Higher exposures to heat than those shown in Table 1 are permissible if the workers have been undergoing medical surveillance and it has been established that they are more tolerant to work in heat than the average worker. Workers should not be permitted to continue their work when their deep body temperature exceeds $38^{o}C$.

Table 1: Permissible Heat Exposure Threshold Limit Values (values are given in ^{o}C WBGT)

Work Regimen	**Work Load**		
	Light	**Moderate**	**Heavy**
Continuous Work	30.0	27.7	25.0
75% Work 25% Rest, Each Hour	30.6	28.0	25.9
50% Work 50% Rest, Each Hour	31.4	29.4	27.9
25% Work 75% Rest, Each Hour	32.2	31.1	30.0

1.2 Description

The Casella Microtherm Heat Stress Wet Bulb Globe Temperature (WBGT) monitor is shown in Figure 1.

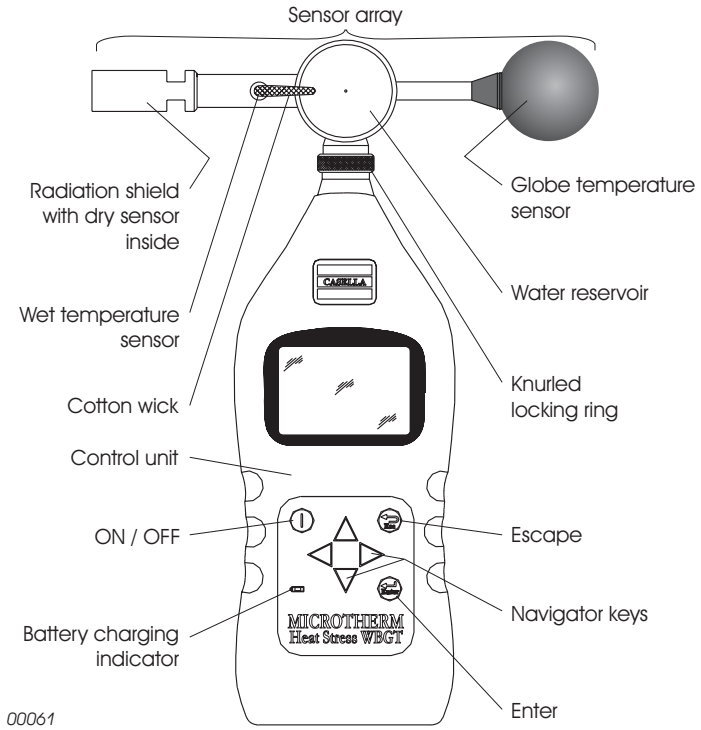

Figure 1: General layout of the Microtherm Heat Stress WBGT

It is a compact, site monitoring instrument intended primarily for tripod mounting but may also be handheld; it has the following main features.

- ¤ LCD graphics display
- ¤ Real-time display
- ¤ Full datalogging facilities as standard
- ¤ Low water level warning
- ¤ Built-in alarm for WBGT levels
- ¤ RH% and dewpoint calculation
- ¤ Automatic calculation of work / rest regimes via PC Software
- ¤ Optional tripod mounting and extension cable
- ¤ Meets the requirements of ISO 7234/ DIN
- ¤ Ergonomic design

The sensor array can be mounted directly on the instrument case, or detached and mounted on a tripod with an extension cable to provide remote sensing. Accuracy is achieved by using Platinum Resistance Temperature Detectors manufactured to high standards of accuracy, stability, and sensitivity. These sensors conform to the requirements of IEC 751 class A and EN 60751 class A. On the sensor array, a radiation shield is provided for the dry temperature sensor.

The instrument will operate from rechargeable batteries, primary cells, or mains power supply while the high definition liquid crystal display is capable of showing both text and graphical information. It also shows instrument configuration details, temperature levels, logger information and battery condition.

The instrument uses a membrane keypad for all control functions, while a serial (RS 232) socket is provided for data transfer to a PC for data manipulation and presentation using Casella WinHSM application software.

1.3 The Sensor Array

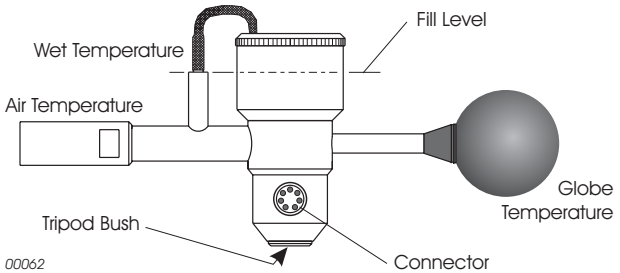

Figure 2: The Sensor Array

The sensor array is illustrated in Figure 2. It consists of three platinum resistance temperature detectors (PRTD) to measure three ambient temperatures as follows.

Wet Temperature Sensor
Mounted vertically with a tubular cotton wick over its length and the end of the cotton extending into a water reservoir. (Always use distilled water.)

Dry Temperature Sensor
Oriented at 90^{o} from the wet temperature sensor and fitted with a radiation shield.

Globe Temperature Sensor
A sensor within a black globe monitors temperature increase due to incident heat radiation.

The complete sensor array can be removed from the control unit and mounted on a tripod for remote operation via extension leads up to 50 m long.

1.4 The Microtherm Menu Structure

The operator interface is based upon a series of menu options organised as shown on the fold-out sheet at the back of this book.

A combination of function keys and navigator keys on the front panel of the instrument are used to move around the menu system and change setup parameters.

Their functions are as follows.

△ and ▽	Navigator keys used to move around the current menu options.
▷ and ◁	Navigator keys used to change the contents of the selected field, such as the indicated date, time, logging interval, etc.
Enter	Enter key that accepts the current menu option or highlighted option.
Esc	Esc (Escape) key that steps back to a previous menu. Press this key several times at any point to obtain a short cut back to the Main menu.

The Main menu contains all parameters and options relevant to operation and gives access to the two sub-menus.

Configuration menu	Allows the instrument parameters to be specified.

Logger	Allows the logger to be configured and data storage to be started and stopped.

1.5 Alarm Output / RS 232 Socket

An alarm output is available which switches from a logic 0 to 5 V DC whenever the on-screen alarm is active.

Figure 3 shows line usage in the connector, while Table 2 identifies the line functions.

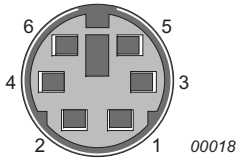

Figure 3:
Line identities of the Alarm / RS 232 socket, viewed externally (i.e. also from the solder bucket side of the plug)

1.6 Schedule of Parts

Table 2: RS 232 Connector line functions

Function	Pin Number	Wire Colour	9-way D Type (PC RS 232)
Ground	1	Yellow	N/A
Alarm	2	Red	N/A
RS 232 Receive in	3	White	3 (TX out)
RS 232 Transmit out	4	Black	2 (RX in)
Comms ground	5	Blue	5 (Ground)
			4 (DTR), 8 (CTS), 6 (DSR) Linked together

Microtherm Control Unit
Sensor Array
Carry Case
RS 232 Lead and PC Software
Water Bottle
Wicks (pack of 10)
User Manual
4 x NiCad Rechargeable Batteries
12 V power supply
Mains Plug - UK Fitting
Mains Plug - European Fitting
Mains Plug - USA Fitting
Mains Plug - Australian Fitting.

Figure 4 shows how the relevant plug adaptor for different local areas is fitted to the power supply unit.

Figure 5 shows the components of the kit installed in the carry case.

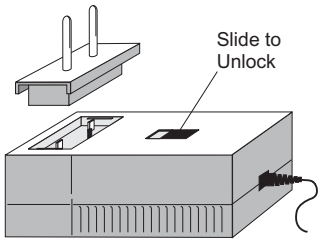

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Figure 4: Fitting plug adaptor

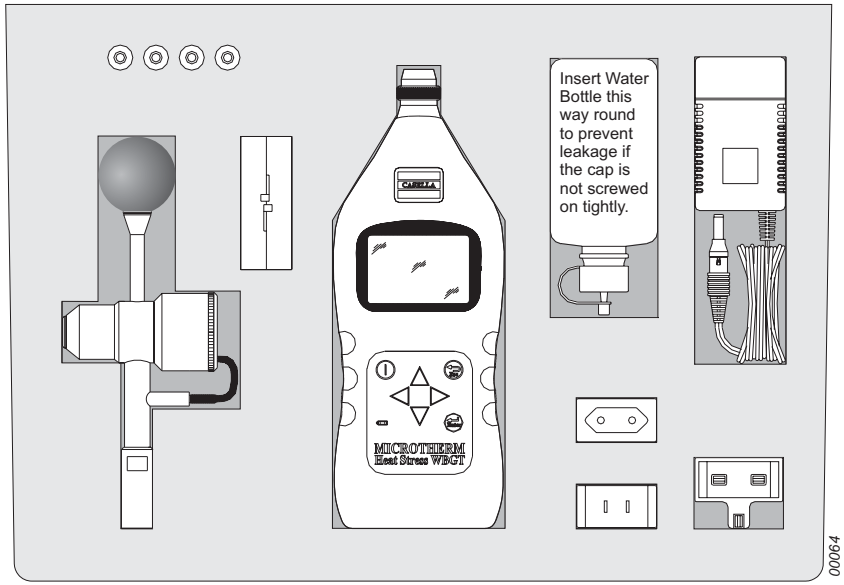

Insert Water Bottle this way round to prevent leakage if the cap is not screwed on tightly.
MICROTHERM
Heat Stress WBGT
00064

Figure 5: The Microtherm Heat Stress WBGT installed in the fitted carying case

2. OPERATION

The Microtherm Heat Stress WBGT is a sensitive scientific instrument which should not be exposed to excessive moisture, vibration, or physical shocks.

The following steps must be performed before your Microtherm can be used under operating conditions. It is suggested that you follow the sequence of sections in this chapter.

2.1 Preparation for Use

2.1.1 Power Supply

The Microtherm is powered by four AA size batteries located in a compartment in the underside of the instrument.

The instrument can also be powered continuously using external power applied via the 12 V DC socket (Figure 6), without the need for internal batteries to be installed. To gain access to the batteries, lift the bottom end of the cover slightly to release it, then slide downwards in the direction of the arrow mark (Figure 7).

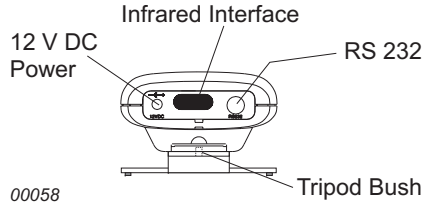


Figure 6: Bottom panel connectors

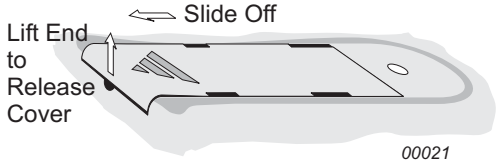


Figure 7: Removing battery cover

Warning !

One cell installed with the wrong polarity may still allow operation, but can cause overheating severe enough to rupture a cell and damage the instrument.

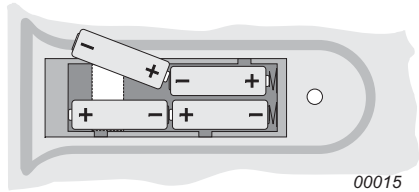


Figure 8: Loading batteries

Load four new batteries (AA or equivalent) in the orientations shown in Figure 8. Rechargeable nickel-cadmium (NiCd) 1.2 V batteries are recommended. 1.5 volt alkaline and other non-rechargeable batteries can also be used.

Rechargeable batteries may be supplied by Casella CEL in a discharged state. In order to obtain maximum capacity from new NiCd batteries, several charge and discharge cycles may be required.

Warning !

DO NOT enable the charger circuit while non-rechargeable batteries are installed.

The instrument has a built in fast-charging circuit that uses power applied via the 12 V DC socket shown in Figure 6. This allows rechargeable batteries to be recharged in-situ.

When rechargeable batteries are to be charged in situ, set the Charger Enable DIP switch to ON as shown in Figure 9.

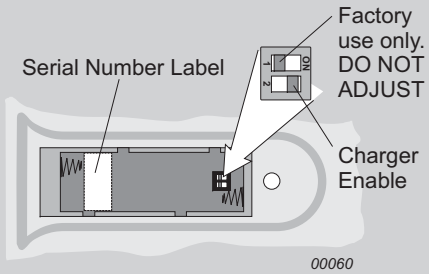


Figure 9: Location of DIP switches

Charging will terminate automatically once the batteries are fully charged, which takes approxi- mately 3 hours for fully discharged batteries.

2.1.2 Temperature Sensor Array

The detachable sensor array houses three platinum resistance temperature detectors to measure three associated ambient temperatures (see Figure 2).

1. The wet temperature sensor is mounted vertically and has a tubular cotton wick sheathing its length.
2. The dry temperature sensor has a radiation shield.
3. The globe temperature sensor is mounted at the other end of the crossbar from the dry sensor.

Connect the sensor array by inserting the cable connector into the socket in the top end of the instrument case, with the red dot facing the front of the instrument to ensure correct pin location, then turn the large knurled ring to tighten the security collet. (Remember to free the collet before attempting to remove the sensor array.)

In use, the sensor array must be maintained with the crossbar horizontal to prevent spillage from the water container during the duration of a typical measurement (which should take at least 20 minutes on each station).

This is best achieved by standing the instrument on its foot on a horizontal surface as shown in Figure 10, mounting the instrument on a tripod (available from Casella CEL), or by using an extension cable to allow the sensor array to be installed on a tripod. Extension cables are available with a standard length of 10 m. The maximum distance between sensors and instrument is 50 m.

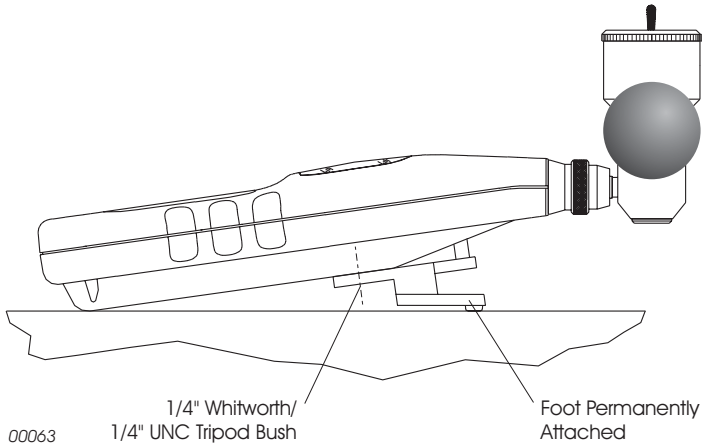


Figure 10: The Microtherm standing on a horizontal surface

The reservoir cap is a tight push fit with an "O" ring seal.

1. **Use only distilled water** and fill the reservoir up to the line engraved inside. Over filling may cause the water to siphon out of the container.

2. Replace the cap after filling.

3. Change the cotton wick if it becomes discoloured.

   Use the supplied screwdriver to tease out the fibres enough to allow

   the wick to be pulled down to the first shoulder on the wet bulb. Also use the screwdriver to ease the wick through the hole in the reservoir cap. Check that the free end of the wick reaches the bottom of the water reservoir.

4. **Empty the reservoir after use.**

2.2 Preliminary Operations

2.2.1 Switching ON and OFF

Warning !

DO NOT use non-rechargeable batteries while the charging circuit is enabled.

1. Press ⏻ to switch your Microtherm ON.

A welcome screen will be displayed showing the instrument's name.

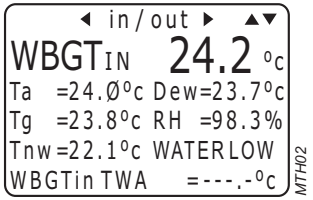
Whenever the internal charger circuit has been enabled as described

in Section 2.1.1 and Figure 9, and external power is applied, i.e. the charger is actually charging the internal batteries, the following warning screen is displayed suggesting that the batteries be checked to make sure they are rechargeable.

The next screen shows information about the instrument, such as battery condition, charger switch setting, memory capacity and the installed firmware (internal software) version.

The charger switch will be shown OFF when no external power is present.

Finally a measurement screen is displayed.



When switched ON the readings may drift a small amount, so allow at least one minute for the instrument to settle.

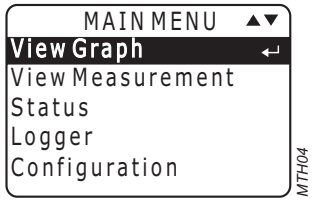
2. Press ⏻ to switch your Microtherm OFF.

2.2.2 Checking Battery Status & Firmware Version

The internal battery voltage is displayed on a Status screen, together with the instrument firmware (internal program) version.

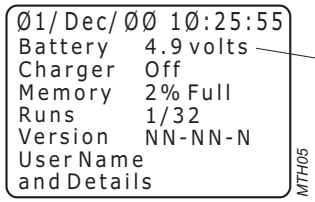
1. Switch the instrument ON and wait for the measurement screen to be displayed, as described in Section 2.2.

2. Press Esc to display the Main menu.



3. Use ▽ or △ to highlight the Status option.

4. Press Enter to display the Status screen.



Ignore the displayed voltage when external power is being used.

When the indicated voltage is greater than 4.8 V, the batteries are in a fully charged condition.

If the voltage from rechargeable batteries is lower than 4.2 V, more than 80% of the capacity has been used.

Consider Recharging !

The battery icon will blink to warn that the internal battery is approaching discharge.

Then when the batteries become discharged, logging is terminated and the instrument will commence an automatic shut down sequence.

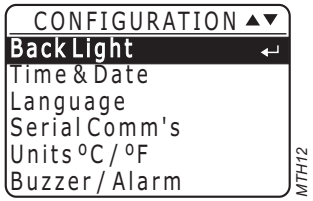
The battery voltage will be shown as 10 V while external power is being applied.

2.2.3 Configuring for the Current Measurement

The Configuration menu enables all functions for the instrument's current operating mode to be defined.

1. With the Main menu on display (see Section 2.2.2), use ▽ or △ to highlight the Configuration option.

2. Press Enter to display the Configuration menu.



3. Specify the user language by pressing Enter while highlighting the Language option.

   The following languages are available:

   English,
   Française,
   Deutsch,
   Italiano,
   Español.

4. Use ▽ or △ to highlight the required language.

5. Press Enter to select the language and return to the Configuration screen.

6. Specify the display back light function by pressing Enter while highlighting the Back Light option.

7. Choose from the following options:

Light ON	The display is lit as you leave this screen. It remains lit until switched off.
Light OFF	Switches the backlight off.
Keypress ON	The display is lit each time a key is pressed while viewing a menu. It remains lit for the duration set.
Duration	Sets the duration timer.

   The duration may be set in 1 second steps anywhere between 5 and

   30 seconds.

8. Press Enter to accept the setting and return to the Configuration menu.

9. Specify the time and date by pressing Enter while highlighting the Time & Date option.

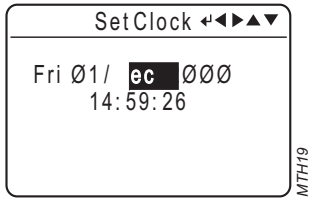
The only option on the Time & Date screen is Set Clock.

The instrument has an internal real-time clock, which should be set to the current time and date.

When data is being logged, the measured temperatures and calculated parameters will be recorded against the current date and time.

However, when the instrument is configured by the WinHSM software, the time and date on the internal clock are set automatically to the PC's time and date. Please refer to Chapter 3 for details.

10. Press Enter to display the Set Clock screen.

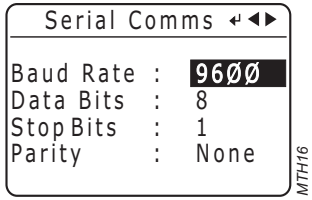


11. Use ▽ or △ to select a time or date field to be edited and ◁ or ▷ to edit the entry in the selected field.

12. Use △ or ▽ to select other fields and ◁ or ▷ to edit the entries.

13. When all entries on the Set Clock screen are correct, press Enter to accept the settings and return to the Time & Date screen.

14. Specify the serial communication details by pressing Enter while highlighting the Serial Comm's option on the Configuration menu.



The Serial Comms screen is displayed, where the only setable parameter is Baud Rate.

15. Use ◁ or ▷ to edit the entry in the Baud Rate field.

16. When the entry matches the requirements of your PC (also see Section 3.3.1), press Enter to accept the setting.

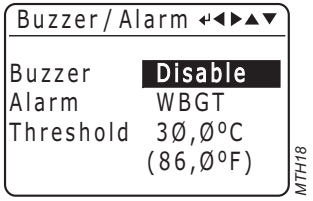
17. Specify whether the measurement units should be °C or °F by pressing Enter while highlighting the Units °C / °F option on the Configuration menu.

18. Use ◁ or ▷ to select the required units.

19. Press Enter to accept the setting.

20. Specify alarm requirements by pressing Enter while highlighting the Buzzer / Alarm option on the Configuration menu.

    The Buzzer / Alarm screen is displayed.



21. Choose from the following options:

Buzzer	Disable, Enable
Alarm	WBGT, WBGTtwa, Disable, Ta,
Threshold	0.0 to 40.0 °C in 0.1° steps.

    As the majority of heat stress legislation is written in terms of °C, threshold alarm settings can be specified only in increments of °C. However, the equivalent °F value is also shown.

22. Press Enter to accept the settings and return to the Configuration menu.

2.3 Calibration

The sensors are manufactured to high standards of accuracy, stability, and sensitivity so that separate calibration is not normally required.

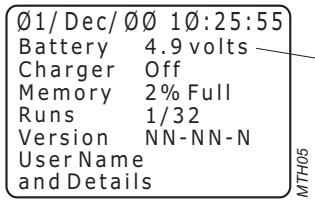
2.4 Measurement

For most consistent measurement, stay at least 20 minutes on each station.

1. If not already on, press ⏻ to swith ON.

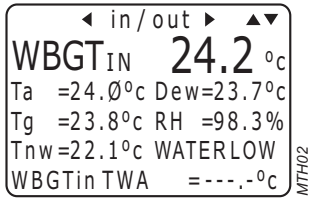
   A welcome screen will be displayed showing the instrument's name.

   This will be followed for a brief period by the status screen.



Ignore the displayed voltage when external power is being used.

   And finally by the measurement screen.



   This displays the following measured or calculated parameters:

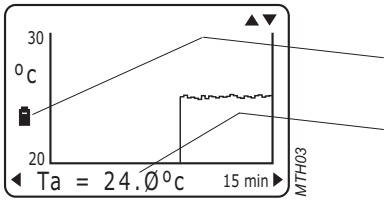
WBGTin	Wet bulb globe temperature - indoors,
Ta	Air temperature,
Tg	Globe temperature,
Tnw	Natural wet temperature,
WBGTin TWA	Wet bulb globe temperature - indoors: time weighted average, given as a rolling 60 minute average every 30 seconds,
Dew	Dewpoint temperature,
RH	%Relative humidity.

2. Press ◁ or ▷ to display:

WBGTout	Wet bulb globe temperature - outdoor,
WBGTout TWA	Wet bulb globe temperature - outdoor: time weighted average, given as a rolling 60 minute average every 30 seconds.

   This screen may also display a water condition warning.

3. Press △ or ▽ to display a profile graph of one of the current measurement parameters.



Battery icon that empties as power is drained

Current parameter value

This graph scrolls across the screen from right to left as samples are collected, with the current parameter and value identified.

4. Press ◁ to change the displayed parameter on the graph.

   The options are:

   Ta,
   WBGT out,
   WBGT in,
   Dewpoint,
   Relative Humidity,
   Tg,
   Tnw.

5. Press ▷ to change the time base between: 15, 30, 60, 120 minutes.

6. Press △ or ▽ again to return to the measurement display.

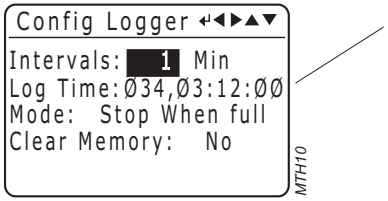
2.5 Data Logging

2.5.1 Configuring the Logger

Before storing data, the logger should be configured for the proposed measurements.

1. Display the Logger screen by selecting the Logger option from the Main Menu.

2. From the Logger screen, select and display the Config Logger screen.



Logging time available (depends upon the intervals set and the amount of free memory space).
The time is shown as: "ddd,hh:mm:ss"

3. Select logger Intervals.

The logger interval is the time between each recorded data point

The following options are available:

30 seconds,
1, 2, 3, 4, 5, 6, 10, 15, 20, 30, 60 minutes.

4. If necessary, change the current setting.

5. Select logger Mode.

   The logger mode determines what happens when all empty memory locations have been filled with data.

6. If necessary, change the setting to one of the following alternatives:

Over Write Run	The logger simply carries on recording data so that the oldest records will be overwritten by new ones.
Stop When Full	The logger stops logging when the memory is full.

2.5.2 Clearing the Logger Memory

The Microtherm has a logging capacity of over 40 000 intervals (giving more than 245 000 individual temperature or relative humidity results) and 32 runs, with the total number of stored runs shown on the Status screen.

When there is insufficient space remaining in the instrument store for the projected logging run, stored data can be deleted. All recorded data should be downloaded before clearing the logger's memory as there are no facilities to recover data deleted from the instrument.

1. Select and display the Config Logger screen (see Section 2.5.1).

2. Highlight the Clear Memory option, select YES then press Enter.

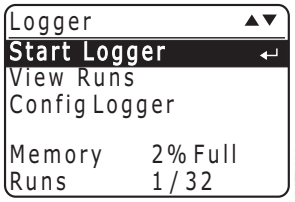
   A warning message will be displayed asking for confirmation before the contents of the memory are erased.

3. Press Enter to confirm the erase operation.

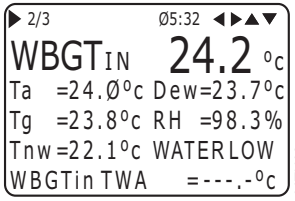
   ALL stored runs will be DELETED.

2.5.3 Start Logging

1. With the logger settings configured as described in Section 2.5.1, (and the memory cleared when necessary) display the Logger screen.



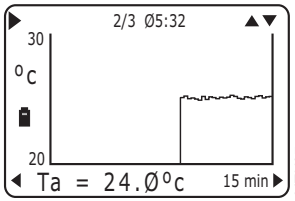
2. Highlight the Start Logger option and press Enter to start logging.



The measurement screen displays levels from the current interval.

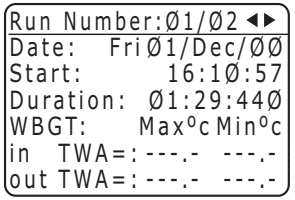
3. Press ◁ and ▷ to switch between displays with WBGT indoor and WBGT outdoor values.

4. Press △ and ▽ to switch between the measurement screen and a graph of one of the parameters.



Both screens identify the run and show the current interval number. Data stored during the current (or other runs) can be reviewed on the instrument display while it is being collected.

5. From the Logger screen, select and display the View Runs screen.

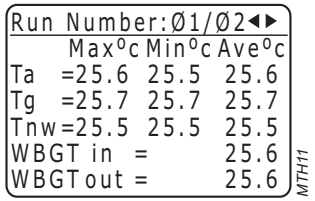


A summary screen for the most recent stored run will be displayed.

6. Use ▽ or △ to select summaries from other runs.

   The run number and total of runs will be indicated; the current run will also be available.

7. Use ◁ or ▷ to display a data screen for the run.



   Maximum, minimum and average values for the whole run are shown.

8. When sufficient data has been collected, stop logging by returning to the Logger screen and using the Stop Logger option.

   Logging stops and data up to the last completed interval is saved.

   At the end of each logging run (i.e. when logging is stopped or the instrument switched off) a summary record will also be saved.

   Each summary record contains the maximum, minimum and average values for the whole run, together with the start date and time plus the run duration.

Stored data can be downloaded for further manipulation and reporting
only by using WinHSM Application Software.

3. WinHSM APPLICATION SOFTWARE

WinHSM Application Software supports the data logger facilities offered by the Microtherm Heat Stress WBGT. It is specifically written by Casella CEL to simplify the process of instrument configuration, downloading and data presentation.

The application, supplied on three 1.44 MB $3^1/_2$" floppy disks, is designed to operate within the 32 bit environment of Windows 95 and later or Windows NT 4 and later.

The instrument communicates with the PC using an RS 232 serial port.

3.1 Installation on Windows 95™, 98™, ME™, Windows NT™ & Windows 2000™

System Requirements:

IBM™ compatible PC with Pentium II or better processor ,
At least 16 MB of free RAM space,
Microsoft Windows 95/98, Windows NT,
Hard drive with at least 4 MB of free space,
RS 232 Serial Communication Port,
$3^1/_2$" high density (1.44 MB) floppy disk drive for program installation,
Super VGA colour monitor,
Printer - optional.

Before installation, it is recommended that a back-up copy be made of the program disks. Keep the originals in a safe place and use the copy to install the software. The Setup program for WinHSM will install files in the specified Program directory and also in the Windows\System directory.

1. Start Windows.
2. Insert WinHSM Disk 1 into the floppy disk drive.
3. Select **Start** from the task bar, then **Run…**
4. Type **a:\setup**, where "a" identifies the floppy disk drive, then press **Enter**.
5. Wait for the Casella CEL welcome screen to be displayed, then follow the on-screen instructions.

   Once installation is complete, a WinHSM icon will be found on your Windows desktop.

3.2 Starting WinHSM Application Software

Start the WinHSM application software by double clicking on its desktop icon, or selecting it from the Start Menu. The top level window will be displayed.

As the cursor is moved to each menu button, the relevant function will be displayed on the message line at the bottom left of the display. If this is the first time that you open the newly installed software, a dialog will be displayed telling you that no profile has been defined and asking you to create and select one before proceeding. Your only option is to click **OK**, which displays the Active Profile dialog, (see Section 3.3.1).

3.3 Profiles

Profiles are used to identify the unique operating parameters of each instrument or measurement application.

In situations where multiple instruments are interrogated by one PC, the use of profiles provides a convenient way of identifying and managing data from each instrument.

Profiles are stored in the PC.

3.3.1 Creating/Editing a Profile

1. Create a new profile by selecting the **Profiles...** option on the Edit menu, or by clicking .

   You will be presented with the Active Profile dialog where the active profile is highlighted.

2. Select the name of a profile to edit or press **New** as appropriate.

3. For a new profile, enter a suitable name in the Profile Name dialog.

   Four tab Properties dialogs define the basic features of the profile.

   The ID dialog specifies the instrument identity and selects a pre-drawn 128 wide by 64 high, black and white bitmap (**.bmp**) for use as a welcome screen

4. Make suitable entries in the fields.

   In addition to normal alpha-numeric characters, the following may also be used in the messages, " + - : ( ) + - # and SPACE".

   The Communications dialog configures the RS 232 serial interface and specifies Modem details.

The Port, Baud Rate and a modem Telephone Number may need to be defined.

5. Make entries in the Comms fields to suit the PC and communications
port in use.

   If a mouse or some other device is already installed on Com1, then change the entry to another free port.

   Also make sure that both PC and Microtherm instrument are set to the same baud rate.

   The Data Files dialog specifies a file prefix and store location for the data files to be downloaded.

   As the instrument may contain data from many different sampling runs, the downloaded data will be split into individual files, each one representing a single run.

   The File Prefix defines the first part of the file name for downloaded data. You may want to add a hyphen (as shown below), to separate the date from the prefix.

   The file name will be of the form:

   fileprefix-yyyy-mm-dd,hh;mm;ss.hsm

   (for example: Site1-2001-02-20,20:14:06.hsm) Where the date and time part of the file name refer to when the run was started.

6. Make a suitable entry.

7. When the default directory is not suitable, use the Browse option to select a file path and directory for storing data files.

   The Units dialog specifies whether the temperatures displayed by the PC will be defined in ^{o}C or ^{o}F.

8. Make a suitable choice.

9. Press **OK** to save the information in the profile.

10. Press **Accept** to accept this as the active profile.

3.3.2 Sending a Profile to the Instrument

The configuration information contained in an instrument profile must be transferred to the Microtherm. Before attempting to send a profile, make sure the instrument is switched on and the serial communications cable plugged into both the instrument and the appropriate port on your PC.

1. Select **Send Profile** from the Comms menu, or click .

   A message will be displayed, warning that this procedure will erase all data in the instrument and asking if you want to continue.

2. Start the transfer.

   Any errors will be reported and the transfer aborted.

   During the transfer, the instrument's internal clock will be reset using
   the date and time from the PC. (Ensure the PC's clock is correctly set !)

3.4 Downloading Data from the Logger

Before you can generate graphs and tables from the data recorded by the Microtherm, you must download it to your PC.

1. Make sure the instrument is switched on and the communications cable plugged into both the Microtherm and the appropriate serial port on your computer.

2. To start downloading, select **Download** from the Comms menu, or click .

   The download sequence can be followed on the PC screen.

   Data from individual sample runs will be saved in separate files.

Note: Although data from uncompleted time intervals is saved in the instrument, it will not be included with the downloaded measurement file. In the extreme case of a run saved with no completed time intervals, the file will not be downloaded.

3.5 Presentation of Data

Three data presentation options are available: summary, table and graph.

When data is displayed using any of these options, use **Print** from the File menu, or click to print a hard copy of the current information or graph on a printer attached on-line to your PC.

Use **Copy** from the Edit menu, or click to copy the current information or graph to your PC clipboard, from where it may be pasted into other applications.

3.5.1 Displaying the Data Summary

Before reviewing a data file stored on the PC, you must open it as follows.

1. Select **Open** from the File menu, or click .

   A dialog will be displayed that allows you to select the data file to be opened.

2. Select and open the required data file.

   The data summary will be displayed as shown in Figure 11.

   This is the starting point for accessing all analysis displays available within the WinHSM software. It shows maximum, minimum and average temperatures, plus the dates and times when the run started and ended.

   Once the file is active, table and graph displays can also be opened.

2. At any time, the Summary screen can be recalled to the display by selecting **Summary** from the View menu or by clicking .

   One each of ISO metabolic rate reference (step 3) and OSHA recommendation (step 9) can be calculated and added to the summary.

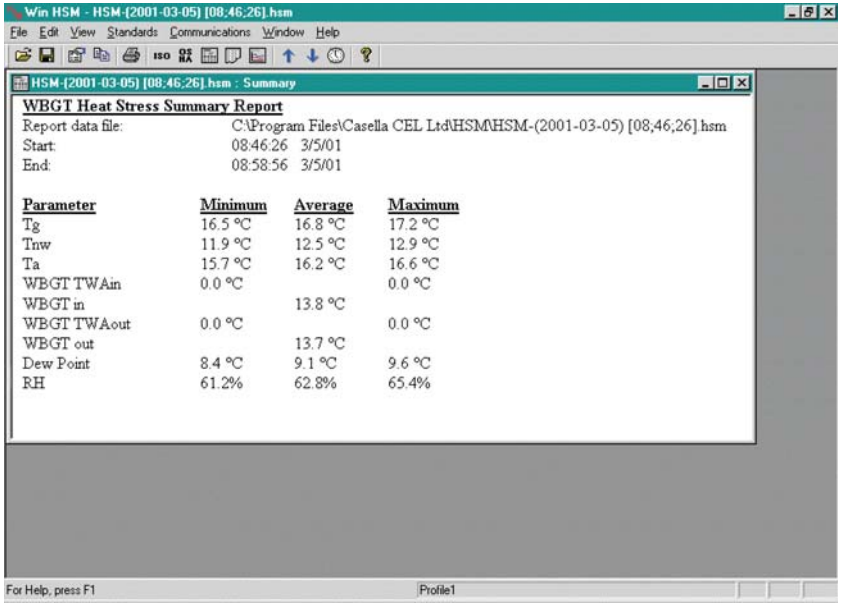

Win HSM - HSM-(2001-03-05) [08;46;26].hsm
File Edit View Standards Communications Window Help
HSM-(2001-03-05) [08;46;26].hsm : Summary
WBGT Heat Stress Summary Report
Report data file: C:\Program Files\Casella CEL Ltd\HSM\HSM-(2001-03-05) [08;46;26].hsm
Start: 08:46:26 3/5/01
End: 08:58:56 3/5/01
Parameter Minimum Average Maximum
Tg 16.5 °C 16.8 °C 17.2 °C
Tnw 11.9 °C 12.5 °C 12.9 °C
Ta 15.7 °C 16.2 °C 16.6 °C
WBGT TWAin 0.0 °C 0.0 °C
WBGT in 13.8 °C
WBGT TWAout 0.0 °C 0.0 °C
WBGT out 13.7 °C
Dew Point 8.4 °C 9.1 °C 9.6 °C
RH 61.2% 62.8% 65.4%
For Help, press F1
Profile1

Figure 11: The results summary

Metabolic Rate
Metabolic class
Class: 3 - High metabolic rate
Metabolic rate (M) range: 200 < M < 260 W/m²
Value to be used for calculation of mean metabolic rate: 230 W/m²
Examples:
Intense arm and trunk work; carrying heavy material; shovelling; sledge hammer work; sawing, planing or chiselling hard wood; hand mowing; digging; walking at a speed of 5.5 km/h to 7 km/h.
Pushing or pulling heavily loaded handcarts or wheelbarrows; chipping castings; concrete block laying.
Heat stress index
Person acclimatised to heat
Sensible air movement
Add to summary
Remove from summary
Reference value of WBGT: 26.0 °C
(assumming clothing worn is permiable to air and steam, with a thermal insulation index Icl = 0.6 Clo)
Close

Figure 12: The ISO metabolic rate calculation dialog

3. Click ISO to select an ISO reference.

   The Metabolic Rate dialog shown in Figure 12 will be displayed.

   The Class field offers the following options:

   0 - Resting
   1 - Low metabolic rate
   2 - Moderate metabolic rate
   3 - High metabolic rate
   4 - Very high metabolic rate

4. Make a selection based on the examples suggested for the class of work performed.

5. If the person is acclimatised to the heat, tick the relevant box (√).

6. Similarly for higher metabolic classes, where there is sensible air movement, tick the relevant box (√).

   The mean metabolic rate and reference WBGT temperature for the class and conditions of work are shown on the dialog.

7. Press **Add to summary** to add the selected values to the summary.

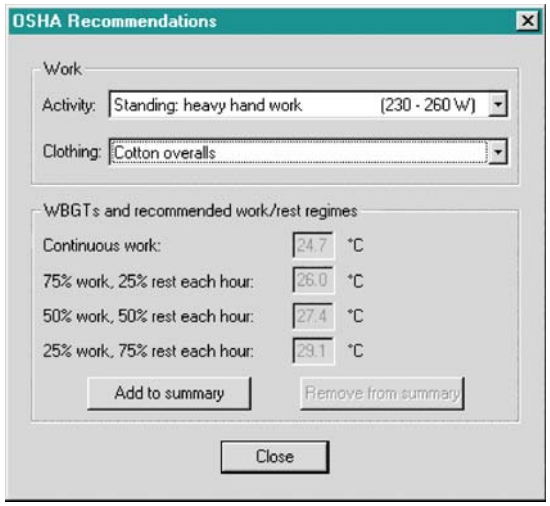


Figure 13: The OSHA recommendations calculation dialog

8. When ISO data is already included in the summary, press **Remove from summary** to remove the calculation.

9. Click OS HA to select an OSHA recommendation.

   The OSHA Recommendations dialog shown in Figure 13 will be displayed.

   The Activity field offers the following options:

Sitting	95 W
Standing	115 W
Standing: light hand work	160 - 210 W
Standing: heavy hand work	210 - 230 W
Standing: heavy hand work	230 - 260 W
Walking at 4 km/h	260 W
Standing: light arm work	315 W
Work with whole body: light	315 W
Standing: heavy arm work (sawing)	420 - 675 W
Work with whole body: moderate	420 W
Work with whole body: heavy	560 W

10. Make a selection based on the examples suggested for the activity.

    The Clothing field offers the following options:

    Light summer clothing
    Cotton overalls

Winter clothing
Water barrier (permeable)

11. Make a selection to suit the clothing worn for the activity.

    The work rest regimes and the reference WBGT temperatures for the
    activity and clothing are shown on the dialog.

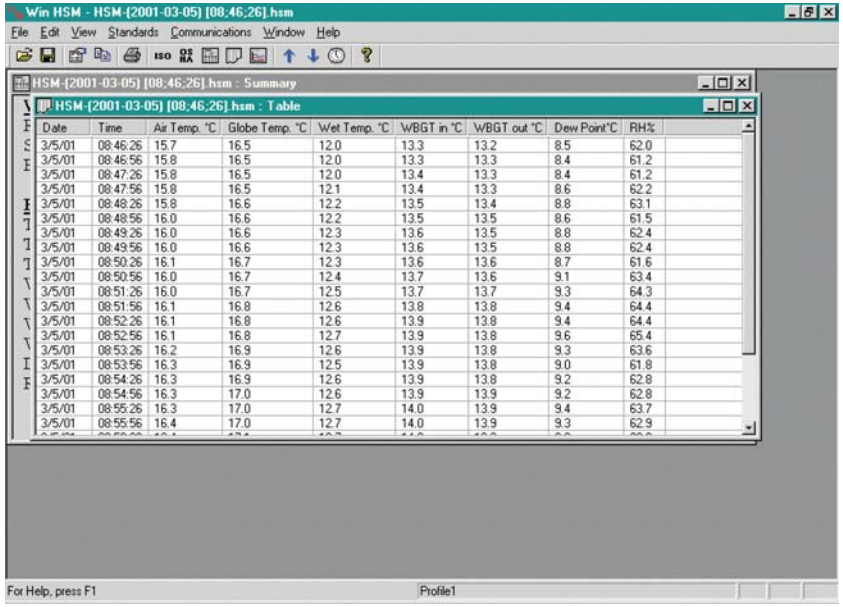
12. Press **Add to summary** to add the selected values to the summary.

13. When OSHA data is already included in the summary, press **Remove from summary** to remove the calculation.

3.5.2 Displaying Data as a Table

Displaying the information as a table allows you to see the actual values stored, together with the date & time of their occurrence.

1. Open the file you want to display as a table, as described in Section 3.5.1.


Win HSM - HSM-(2001-03-05) [08;46;26].hsm
File Edit View Standards Communications Window Help
HSM-(2001-03-05) [08;46;26].hsm : Summary
HSM-(2001-03-05) [08;46;26].hsm : Table
For Help, press F1
Profile1

Date	Time	Air Temp. °C	Globe Temp. °C	Wet Temp. °C	WBGT in °C	WBGT out °C	Dew Point °C	RH%
3/5/01	08:46:26	15.7	16.5	12.0	13.3	13.2	8.5	62.0
3/5/01	08:46:56	15.8	16.5	12.0	13.3	13.3	8.4	61.2
3/5/01	08:47:26	15.8	16.5	12.0	13.4	13.3	8.4	61.2
3/5/01	08:47:56	15.8	16.5	12.1	13.4	13.3	8.6	62.2
3/5/01	08:48:26	15.8	16.6	12.2	13.5	13.4	8.8	63.1
3/5/01	08:48:56	16.0	16.6	12.2	13.5	13.5	8.6	61.5
3/5/01	08:49:26	16.0	16.6	12.3	13.6	13.5	8.8	62.4
3/5/01	08:49:56	16.0	16.6	12.3	13.6	13.5	8.8	62.4
3/5/01	08:50:26	16.1	16.7	12.3	13.6	13.6	8.7	61.6
3/5/01	08:50:56	16.0	16.7	12.4	13.7	13.6	9.1	63.4
3/5/01	08:51:26	16.0	16.7	12.5	13.7	13.7	9.3	64.3
3/5/01	08:51:56	16.1	16.8	12.6	13.8	13.8	9.4	64.4
3/5/01	08:52:26	16.1	16.8	12.6	13.9	13.8	9.4	64.4
3/5/01	08:52:56	16.1	16.8	12.7	13.9	13.8	9.6	65.4
3/5/01	08:53:26	16.2	16.9	12.6	13.9	13.8	9.3	63.6
3/5/01	08:53:56	16.3	16.9	12.5	13.9	13.8	9.0	61.8
3/5/01	08:54:26	16.3	16.9	12.6	13.9	13.8	9.2	62.8
3/5/01	08:54:56	16.3	17.0	12.6	13.9	13.9	9.2	62.8
3/5/01	08:55:26	16.3	17.0	12.7	14.0	13.9	9.4	63.7
3/5/01	08:55:56	16.4	17.0	12.7	14.0	13.9	9.3	62.9

Figure 14: Data presented as a table

2. Select **Table** from the View menu or click .

   A table that includes all of the records in the file will be displayed, as shown in Figure 14.

3. Use the vertical scroll bar to move up and down within the table.

3.5.3 Displaying Data as a Graph

1. Open the file you want to display as a graph, as described in Section 3.5.1.

2. Select **Graph** from the View menu or click .

   The graph will be displayed as shown in Figure 15. Both axes of the graph are scaled automatically to cover the full range of values stored and the entire time period contained in the data file. The different traces are identified by colour.

3. Tick the relevant boxes (√) to display the required temperature parameters on the graph.

   The graph is redrawn immediately to include the marked parameters.

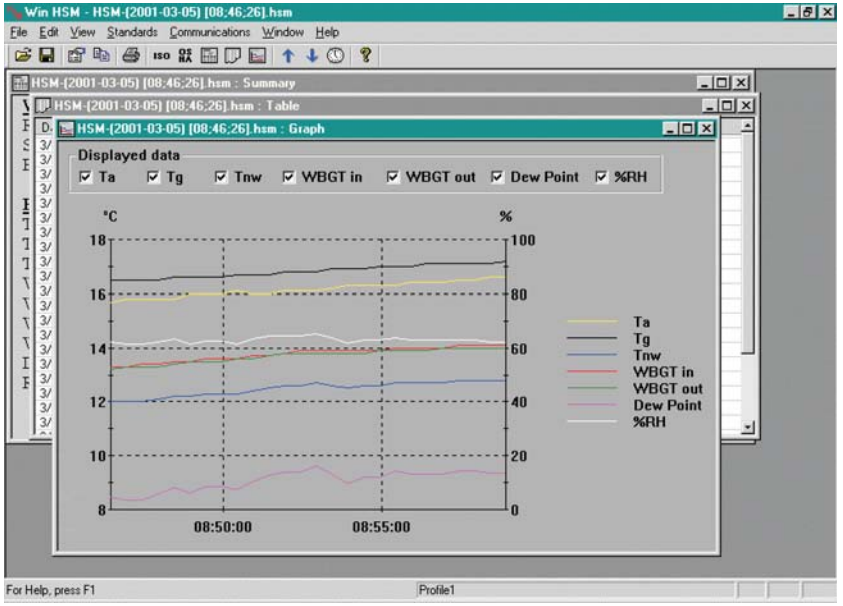


Figure 15: Data presented as a graph

3.5.4 Exporting Data to Other Applications

WinHSM data files (**.hsm**) can be imported into other applications.

Data files created by WinHSM software are saved as comma delimited ASCII text. Each set of readings is saved as a single line terminated by a carriage return/ line feed pair.

These files are easily imported into many commercial word processor and spreadsheet applications such as Microsoft Word™ and Excel™.

3.6 Real-Time Display Mode

The WinHSM application software is able to provide a real time graphical display of the Microtherm current readings. Scrolling real time traces provide a clear indication of changes in temperature or relative humidity as they occur.

Before using the real time display facility, ensure that your Microtherm is switched on and connected to the appropriate serial port of your PC.

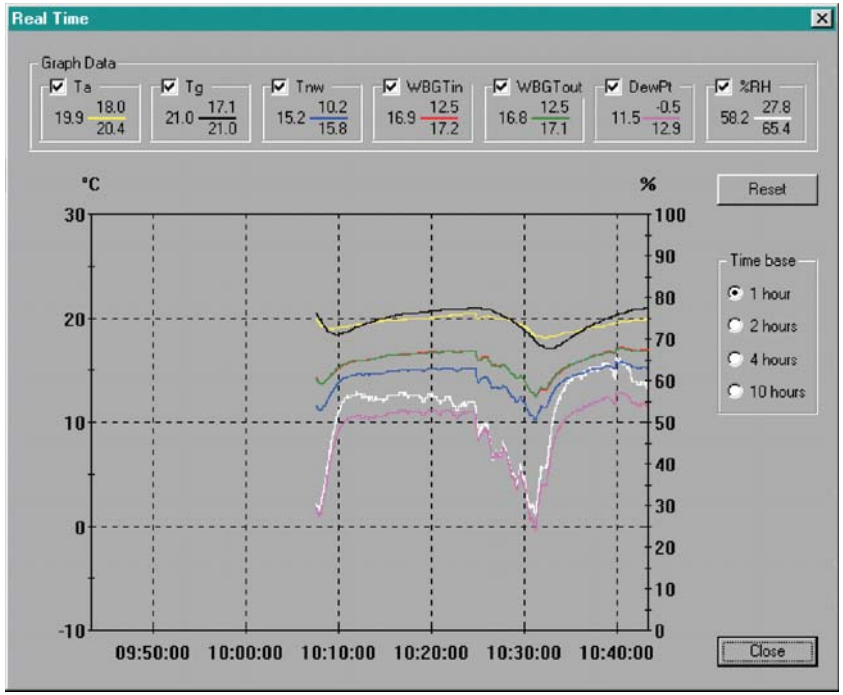


Figure 16: The real-time display

1. Select **Real Time** from the Comms menu, or click .

   The real time window is displayed.

   Measured profiles for the run will start immediately scrolling from the right, as shown in Figure: 16.

   The vertical axis of the graph is scaled automatically to cover the full range of values measured, with temperatures shown on the left axis and relative humidity to 100% on the right axis.

   The header for each parameter identifies the trace by colour and also

   shows the following information:

   $$\textit{Current Value}\ \frac{\textit{Minimum Value}}{\textit{Maximum Value}} \Leftarrow \text{Colour Code Line}$$

2. Tick the relevant boxes (√) to display the required parameters.

3. Press the **Reset** button to clear existing values.

   The field to the right of the Graph allows the time scale of the x-axis to be switched between 1, 2, 4 and 10 hours.

4. Press a suitable button to select the required time scale.

2. OPERATION

The Microtherm Heat Stress WBGT is a sensitive scientific instrument which should not be exposed to excessive moisture, vibration, or physical shocks.

The following steps must be performed before your Microtherm can be used under operating conditions. It is suggested that you follow the sequence of sections in this chapter.

2.1 Preparation for Use

2.1.1 Power Supply

The Microtherm is powered by four AA size batteries located in a compartment in the underside of the instrument.

The instrument can also be powered continuously using external power applied via the 12 V DC socket (Figure 6), without the need for internal batteries to be installed. To gain access to the batteries, lift the bottom end of the cover slightly to release it, then slide downwards in the direction of the arrow mark (Figure 7).

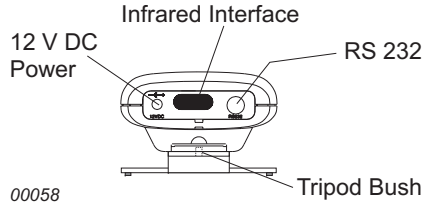


Figure 6: Bottom panel connectors

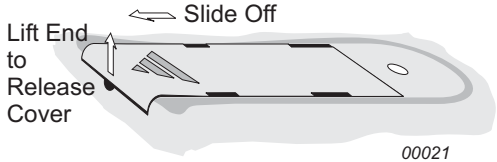


Figure 7: Removing battery cover

Warning !

One cell installed with the wrong polarity may still allow operation, but can cause overheating severe enough to rupture a cell and damage the instrument.

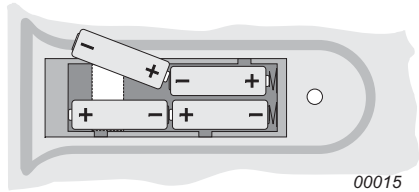


Figure 8: Loading batteries

Load four new batteries (AA or equivalent) in the orientations shown in Figure 8. Rechargeable nickel-cadmium (NiCd) 1.2 V batteries are recommended. 1.5 volt alkaline and other non-rechargeable batteries can also be used.

Rechargeable batteries may be supplied by Casella CEL in a discharged state. In order to obtain maximum capacity from new NiCd batteries, several charge and discharge cycles may be required.

Warning !

DO NOT enable the charger circuit while non-rechargeable batteries are installed.

The instrument has a built in fast-charging circuit that uses power applied via the 12 V DC socket shown in Figure 6. This allows rechargeable batteries to be recharged in-situ.

When rechargeable batteries are to be charged in situ, set the Charger Enable DIP switch to ON as shown in Figure 9.

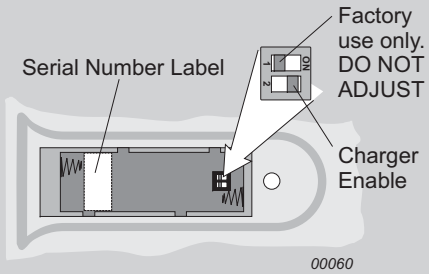


Figure 9: Location of DIP switches

Charging will terminate automatically once the batteries are fully charged, which takes approxi- mately 3 hours for fully discharged batteries.

2.1.2 Temperature Sensor Array

The detachable sensor array houses three platinum resistance temperature detectors to measure three associated ambient temperatures (see Figure 2).

1. The wet temperature sensor is mounted vertically and has a tubular cotton wick sheathing its length.
2. The dry temperature sensor has a radiation shield.
3. The globe temperature sensor is mounted at the other end of the crossbar from the dry sensor.

Connect the sensor array by inserting the cable connector into the socket in the top end of the instrument case, with the red dot facing the front of the instrument to ensure correct pin location, then turn the large knurled ring to tighten the security collet. (Remember to free the collet before attempting to remove the sensor array.)

In use, the sensor array must be maintained with the crossbar horizontal to prevent spillage from the water container during the duration of a typical measurement (which should take at least 20 minutes on each station).

This is best achieved by standing the instrument on its foot on a horizontal surface as shown in Figure 10, mounting the instrument on a tripod (available from Casella CEL), or by using an extension cable to allow the sensor array to be installed on a tripod. Extension cables are available with a standard length of 10 m. The maximum distance between sensors and instrument is 50 m.

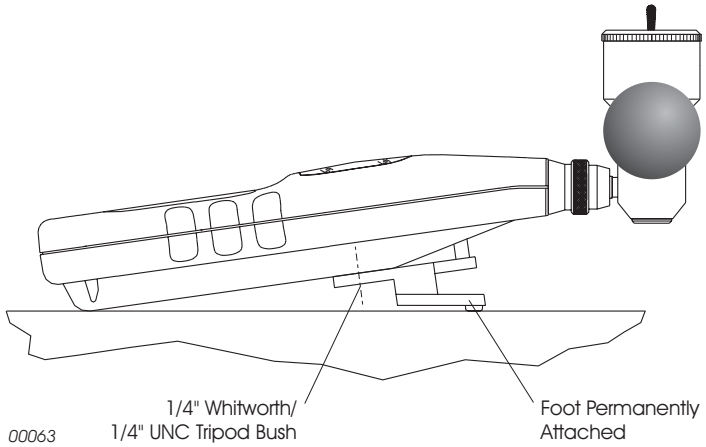


Figure 10: The Microtherm standing on a horizontal surface

The reservoir cap is a tight push fit with an "O" ring seal.

1. **Use only distilled water** and fill the reservoir up to the line engraved inside. Over filling may cause the water to siphon out of the container.

2. Replace the cap after filling.

3. Change the cotton wick if it becomes discoloured.

   Use the supplied screwdriver to tease out the fibres enough to allow

   the wick to be pulled down to the first shoulder on the wet bulb. Also use the screwdriver to ease the wick through the hole in the reservoir cap. Check that the free end of the wick reaches the bottom of the water reservoir.

4. **Empty the reservoir after use.**

2.2 Preliminary Operations

2.2.1 Switching ON and OFF

Warning !

DO NOT use non-rechargeable batteries while the charging circuit is enabled.

1. Press ⏻ to switch your Microtherm ON.

A welcome screen will be displayed showing the instrument's name.

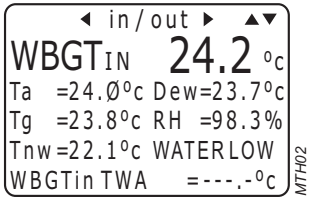
Whenever the internal charger circuit has been enabled as described

in Section 2.1.1 and Figure 9, and external power is applied, i.e. the charger is actually charging the internal batteries, the following warning screen is displayed suggesting that the batteries be checked to make sure they are rechargeable.

The next screen shows information about the instrument, such as battery condition, charger switch setting, memory capacity and the installed firmware (internal software) version.

The charger switch will be shown OFF when no external power is present.

Finally a measurement screen is displayed.



When switched ON the readings may drift a small amount, so allow at least one minute for the instrument to settle.

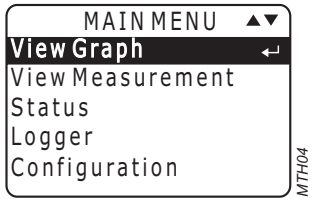
2. Press ⏻ to switch your Microtherm OFF.

2.2.2 Checking Battery Status & Firmware Version

The internal battery voltage is displayed on a Status screen, together with the instrument firmware (internal program) version.

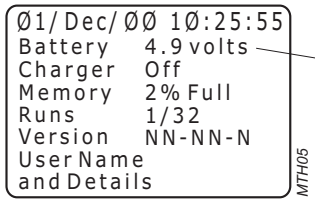
1. Switch the instrument ON and wait for the measurement screen to be displayed, as described in Section 2.2.

2. Press Esc to display the Main menu.



3. Use ▽ or △ to highlight the Status option.

4. Press Enter to display the Status screen.



Ignore the displayed voltage when external power is being used.

When the indicated voltage is greater than 4.8 V, the batteries are in a fully charged condition.

If the voltage from rechargeable batteries is lower than 4.2 V, more than 80% of the capacity has been used.

Consider Recharging !

The battery icon will blink to warn that the internal battery is approaching discharge.

Then when the batteries become discharged, logging is terminated and the instrument will commence an automatic shut down sequence.

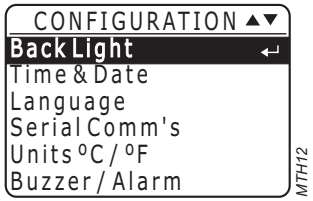
The battery voltage will be shown as 10 V while external power is being applied.

2.2.3 Configuring for the Current Measurement

The Configuration menu enables all functions for the instrument's current operating mode to be defined.

1. With the Main menu on display (see Section 2.2.2), use ▽ or △ to highlight the Configuration option.

2. Press Enter to display the Configuration menu.



3. Specify the user language by pressing Enter while highlighting the Language option.

   The following languages are available:

   English,
   Française,
   Deutsch,
   Italiano,
   Español.

4. Use ▽ or △ to highlight the required language.

5. Press Enter to select the language and return to the Configuration screen.

6. Specify the display back light function by pressing Enter while highlighting the Back Light option.

7. Choose from the following options:

Light ON	The display is lit as you leave this screen. It remains lit until switched off.
Light OFF	Switches the backlight off.
Keypress ON	The display is lit each time a key is pressed while viewing a menu. It remains lit for the duration set.
Duration	Sets the duration timer.

   The duration may be set in 1 second steps anywhere between 5 and

   30 seconds.

8. Press Enter to accept the setting and return to the Configuration menu.

9. Specify the time and date by pressing Enter while highlighting the Time & Date option.

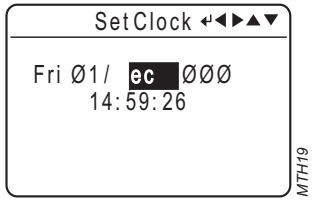
The only option on the Time & Date screen is Set Clock.

The instrument has an internal real-time clock, which should be set to the current time and date.

When data is being logged, the measured temperatures and calculated parameters will be recorded against the current date and time.

However, when the instrument is configured by the WinHSM software, the time and date on the internal clock are set automatically to the PC's time and date. Please refer to Chapter 3 for details.

10. Press Enter to display the Set Clock screen.

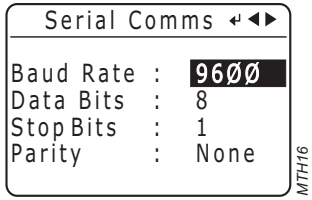


11. Use ▽ or △ to select a time or date field to be edited and ◁ or ▷ to edit the entry in the selected field.

12. Use △ or ▽ to select other fields and ◁ or ▷ to edit the entries.

13. When all entries on the Set Clock screen are correct, press Enter to accept the settings and return to the Time & Date screen.

14. Specify the serial communication details by pressing Enter while highlighting the Serial Comm's option on the Configuration menu.



The Serial Comms screen is displayed, where the only setable parameter is Baud Rate.

15. Use ◁ or ▷ to edit the entry in the Baud Rate field.

16. When the entry matches the requirements of your PC (also see Section 3.3.1), press Enter to accept the setting.

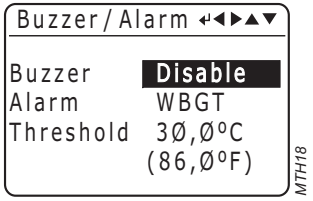
17. Specify whether the measurement units should be °C or °F by pressing Enter while highlighting the Units °C / °F option on the Configuration menu.

18. Use ◁ or ▷ to select the required units.

19. Press Enter to accept the setting.

20. Specify alarm requirements by pressing Enter while highlighting the Buzzer / Alarm option on the Configuration menu.

    The Buzzer / Alarm screen is displayed.



21. Choose from the following options:

Buzzer	Disable, Enable
Alarm	WBGT, WBGTtwa, Disable, Ta,
Threshold	0.0 to 40.0 °C in 0.1° steps.

    As the majority of heat stress legislation is written in terms of °C, threshold alarm settings can be specified only in increments of °C. However, the equivalent °F value is also shown.

22. Press Enter to accept the settings and return to the Configuration menu.

2.3 Calibration

The sensors are manufactured to high standards of accuracy, stability, and sensitivity so that separate calibration is not normally required.

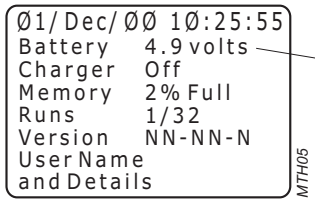
2.4 Measurement

For most consistent measurement, stay at least 20 minutes on each station.

1. If not already on, press ⏻ to swith ON.

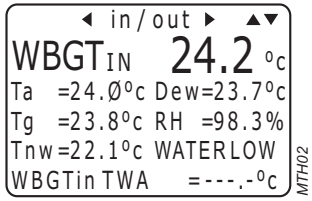
   A welcome screen will be displayed showing the instrument's name.

   This will be followed for a brief period by the status screen.



Ignore the displayed voltage when external power is being used.

   And finally by the measurement screen.



   This displays the following measured or calculated parameters:

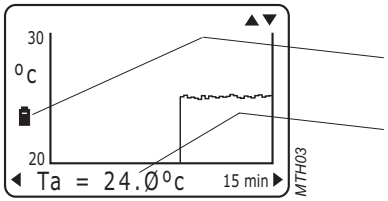
WBGTin	Wet bulb globe temperature - indoors,
Ta	Air temperature,
Tg	Globe temperature,
Tnw	Natural wet temperature,
WBGTin TWA	Wet bulb globe temperature - indoors: time weighted average, given as a rolling 60 minute average every 30 seconds,
Dew	Dewpoint temperature,
RH	%Relative humidity.

2. Press ◁ or ▷ to display:

WBGTout	Wet bulb globe temperature - outdoor,
WBGTout TWA	Wet bulb globe temperature - outdoor: time weighted average, given as a rolling 60 minute average every 30 seconds.

   This screen may also display a water condition warning.

3. Press △ or ▽ to display a profile graph of one of the current measurement parameters.



Battery icon that empties as power is drained

Current parameter value

This graph scrolls across the screen from right to left as samples are collected, with the current parameter and value identified.

4. Press ◁ to change the displayed parameter on the graph.

   The options are:

   Ta,
   WBGT out,
   WBGT in,
   Dewpoint,
   Relative Humidity,
   Tg,
   Tnw.

5. Press ▷ to change the time base between: 15, 30, 60, 120 minutes.

6. Press △ or ▽ again to return to the measurement display.

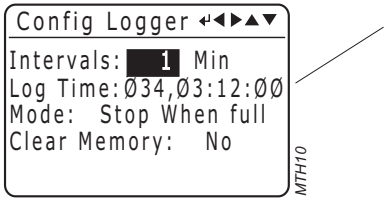
2.5 Data Logging

2.5.1 Configuring the Logger

Before storing data, the logger should be configured for the proposed measurements.

1. Display the Logger screen by selecting the Logger option from the Main Menu.

2. From the Logger screen, select and display the Config Logger screen.



Logging time available (depends upon the intervals set and the amount of free memory space).
The time is shown as: "ddd,hh:mm:ss"

3. Select logger Intervals.

The logger interval is the time between each recorded data point

The following options are available:

30 seconds,
1, 2, 3, 4, 5, 6, 10, 15, 20, 30, 60 minutes.

4. If necessary, change the current setting.

5. Select logger Mode.

   The logger mode determines what happens when all empty memory locations have been filled with data.

6. If necessary, change the setting to one of the following alternatives:

Over Write Run	The logger simply carries on recording data so that the oldest records will be overwritten by new ones.
Stop When Full	The logger stops logging when the memory is full.

2.5.2 Clearing the Logger Memory

The Microtherm has a logging capacity of over 40 000 intervals (giving more than 245 000 individual temperature or relative humidity results) and 32 runs, with the total number of stored runs shown on the Status screen.

When there is insufficient space remaining in the instrument store for the projected logging run, stored data can be deleted. All recorded data should be downloaded before clearing the logger's memory as there are no facilities to recover data deleted from the instrument.

1. Select and display the Config Logger screen (see Section 2.5.1).

2. Highlight the Clear Memory option, select YES then press Enter.

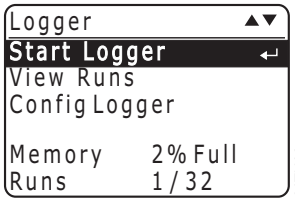
   A warning message will be displayed asking for confirmation before the contents of the memory are erased.

3. Press Enter to confirm the erase operation.

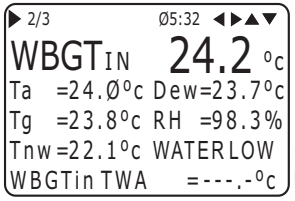
   ALL stored runs will be DELETED.

2.5.3 Start Logging

1. With the logger settings configured as described in Section 2.5.1, (and the memory cleared when necessary) display the Logger screen.



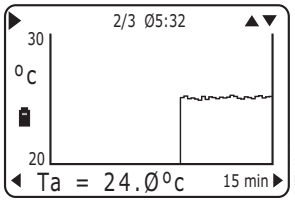
2. Highlight the Start Logger option and press Enter to start logging.



The measurement screen displays levels from the current interval.

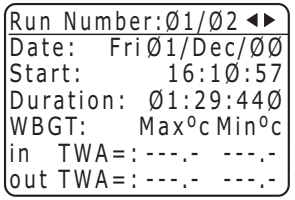
3. Press ◁ and ▷ to switch between displays with WBGT indoor and WBGT outdoor values.

4. Press △ and ▽ to switch between the measurement screen and a graph of one of the parameters.



Both screens identify the run and show the current interval number. Data stored during the current (or other runs) can be reviewed on the instrument display while it is being collected.

5. From the Logger screen, select and display the View Runs screen.

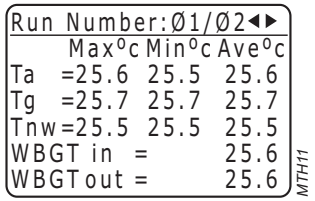


A summary screen for the most recent stored run will be displayed.

6. Use ▽ or △ to select summaries from other runs.

   The run number and total of runs will be indicated; the current run will also be available.

7. Use ◁ or ▷ to display a data screen for the run.



   Maximum, minimum and average values for the whole run are shown.

8. When sufficient data has been collected, stop logging by returning to the Logger screen and using the Stop Logger option.

   Logging stops and data up to the last completed interval is saved.

   At the end of each logging run (i.e. when logging is stopped or the instrument switched off) a summary record will also be saved.

   Each summary record contains the maximum, minimum and average values for the whole run, together with the start date and time plus the run duration.

Stored data can be downloaded for further manipulation and reporting
only by using WinHSM Application Software.

5. SPECIFICATION

5.1 Instrument Specification

Measurement

Sensing technique:	Platinum Resistance Temperature Detectors, 100 Ω elements to EN 60751 Class A using 4-wire cable up to 30 m,
Ta, Dry Bulb (Air):	Measuring Range: 10 - 60°C, Accuracy: ±0.5°C,
Tg, Globe:	Measuring Range: 20 - 120°C, Accuracy 20 - 50°C: ±0.5°C, Accuracy 50 - 120°C: ±1.0°C,
Tnw, Natural Wet:	Measuring Range: 5 - 40°C, Accuracy: ±0.5°C,
Relative Humidity:	Less than ±5% from 35 - 100% RH,
Resolution:	0.1° for temperature, 0.1% for RH.

For inside/outside measurements with no solar load:
Use WBGTin = 0.7Tnw + 0.3Ta.
For outside measurements with solar load:
Use WBGTout = 0.7Tnw + 0.2Tg + 0.1Ta.

Power Supply

Instrument Consumption:	Approx. 30 mA.
Battery:	4 x AA / MN1500 cells Alkaline or rechargeable NiMH.
Typical operating time:	Alkaline Batteries (2700 mAh), >85 hours, Rechargeable NiMH cells (1700 mAh), >40 hours
Battery Charging	Internal NiCd fast charger circuitry. Charge termination based on Negative delta V detection with additional time-out protection. The charger must be disabled for dry cell operation.
Charge Rate	Fast charge rate 450 mA, Standby charge rate 55 mA approx.
Power adaptor	Universal with input voltage range 100 - 240 V AC, 47 - 63 Hz. Output 12 V DC at 0.8 A. Supplied with connectors for UK, USA, Australian and European mains outlet sockets. The instrument may be powered continuously from the power adaptor.

Physical

Display:	128 x 64 pixel LCD Graphics panel with backlight.
Keypad:	7 key tactile membrane
Weight:	Instrument with sensor array: 0.97 kg. Complete kit in carrying case: 4.05 kg.
Dimensions:	Instrument: 245 x 95 x 50 mm. Sensor Array: 90 high x 225 x 69 mm. Carrying case: 135 x 490 x 370 mm.

Displayed and Stored Values

Wet Bulb Globe Temperature Indoor,
Wet Bulb Globe Temperature Outdoor,
Wet Bulb Globe Temperature Indoor Time Weighted Average,
Wet Bulb Globe Temperature Outdoor Time Weighted Average,
Ta, Dry Bulb (Air),
Tg, Globe,
Tnw, Natural Wet,
Dewpoint (calculated),
Relative Humidity Percent (calculated).

All temperatures levels may be selected for display in ^{O}C or ^{O}F.

The time weighted average (TWA) values represent the rolling 1 hour

average since the instrument was switched on, or a logging run was started.

The TWA value is updated every 30 seconds. During the first hour, the value is shown as "- - - . -".

Additional Stored Values

Wet Bulb Globe Temperature Indoor
- Max, Min and Average values,

Wet Bulb Globe Temperature Outdoor
- Max, Min and Average values,

Wet Bulb Globe Temperature Indoor Time Weighted Average
- Max and Min values,

Wet Bulb Globe Temperature Outdoor Time Weighted Average
- Max and Min values,

Ta, Dry Bulb (Air - Max, Min and Average values),
Tg, Globe - Max, Min and Average values,
Tnw, Natural Wet - Max, Min and Average values.

Time weighted average values represent the average since the instrument was switched on, or reset.

Additional Displayed Information

Battery voltage,
Charger circuit status,
Memory status,
Number of runs saved,
Firmware version,
User name and details.

Data Logger

Internal memory:	512 k RAM (with back-up battery) that provides space for over 49 000 intervals, so that when all five temperature and humidity parameters are enabled, a total of 245 000 individual results can be saved.
Logger Interval:	Adjustable from 30 seconds to 60 minutes.
Recorded Values:	Measured levels for the logging interval. Maximum, minimum and average values for the entire logging period are saved at the end of each logging run.
Serial Interface:	RS232 up to 38,400 baud. Infrared Interface (Future expansion).
Alarm output:	+5 V DC when the alarm is activated, 0 V while the alarm is inactive.

5.2 WinHSM, PC Based Application Software

Provides a friendly graphical interface for instrument configuration, data download and graphical report presentation.

Operating System	M.S. Windows™ 95/98/ME/2000 and NT compatible, Pentium II or better processor, 200 MHz recommended for real time mode, Requires 1.44 MB $3^1/_2$ " floppy disk drive, RS232 serial port, 16 MB RAM, FDD and HDD, Super VGA colour graphics.

5.3 Spare Parts

107039A	Spare Wicks (pack of 10).

5.4 Optional Accessories

176086B	Car Charging Lead
180043B	10 m Extension Cable

5.5 CE Compliance

The Microtherm Heat Stress WBGT complies with the EMC Directive 89/336/EEC of the European Union. It has been tested according to the standard delivery schedule and complies with the following standards.

EN 50081-1 : 1992, EN 50081-2 : 1993:
Generic emission standards for residential, commercial, light industry and industrial environments.

EN 50082-1 : 1992, EN 50082-2 : 1995:
Generic immunity standards (for both RF fields and electrostatic discharge) for residential, commercial, light industry and industrial environments.

EN 61000-4-2 : 1995, IEC 61000-4-2 : 1995:
Electromagnetic compatability (EMC). Testing and measurement techniques. Electrostatic discharge immunity test.

Thank you for reading this data sheet.

For pricing or for further information, please contact us at our UK Office, using the details below.

UK Office
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Tel: +44 (0)1245 600560
Fax: +44 (0)1245 808399
Email: sales@keison.co.uk

Please note - Product designs and specifications are subject to change without notice. The user is responsible for determining the suitability of this product.